

Forestcast Season 2: Backcross- Episode 4:

A Return to Elm Street

Audio Transcript

Jennifer Koch

With elm, there's papers that I've read as early as the 1970s that talked about seeing natural resistance and how, over time, they thought that natural selection would lead to increasing numbers, and size, of elm. So, with Dutch elm disease, elm is not at risk of extinction, but elm does not reach the huge, large sizes that it used to reach. Which, in all honesty, was a very small portion of the elm population to begin with, but it was the popular street tree that people loved.

Jonathan Yales

Welcome back to Backcross, the story of how resistance breeds restoration. This is Part 4—the story of the American elm. I'm Jon Yales.

Jennifer Koch

So, as early as the 1930s, people started doing massive seedling screens and just doing selections, and doing inoculations, and so the first tolerant trees were identified a long, long time ago. But, the goal was to develop another street tree, so they were just looking for a single cultivar with enough tolerance that they could replace the street trees that were lost. What the Forest Service is focusing now on is forest restoration. And, Kathleen's done work using different species in the riparian areas where green ash was dominant, trying to find species that can sort of, you know, be a placeholder and keep these ecosystems alive and provide those ecosystem services in the absence of ash, and buy time.

Jonathan Yales

Kathleen Knight is a research ecologist based in Delaware, Ohio. We met her back in Part 1.

Kathleen Knight

So, we planted elm, sycamore, and pin oak in floodplain forests in Toledo, Columbus, and a small town in eastern Ohio, looking at their performance in these areas where the ash trees either had already been killed by emerald ash borer, or were starting to be killed by emerald ash borer, to look at whether you can underplant, or replant, with these other tree species to keep those floodplains forested, and maintain that ecosystem function.

Jonathan Yales

What's the reason we're restoring elms in the first place? Like, what has attacked them?

Kathleen Knight

So, elms are under threat from a disease called Dutch elm disease, and that's actually a fungus that's spread by a bark beetle. So, the beetle gets the fungal spores on it when it emerges from an elm tree, and then when it goes to another elm tree and starts to feed on the bark of that tree, it spreads those

fungus spores and they start growing through the vascular system of the elm tree. And, as the fungus grows within that tree, it actually kills the elm tree and you'll see wilting, maybe, of one branch, and then another branch, the leaves wilt, the tree's vasculature has shut down—so that tree's not able to transport water very well—and the tree will [die], usually, pretty rapidly.

Jonathan Yales

So, where are we at with Dutch elm disease timeline-wise? Like, when did that enter the United States, and when did that start affecting our trees? Are we towards the middle of that, the beginning of that process, the end of it, has it passed, like, where are we at with Dutch elm?

Kathleen Knight

So, Dutch elm disease entered the U.S. in the 1930s, and spread pretty rapidly, and it's actually already spread through pretty much all of the range of American elm in the U.S. So, most elms have already been exposed to the disease at this point.

Jonathan Yales

And, what does, like, the timeline for this type of species restoration actually look like? Obviously, that's a massive undertaking to restore either a forest, or an entire species, like, if you had to lay that out from, you know, day one to the end of whatever our goal may be, what does that look like?

Kathleen Knight

So, it is a huge undertaking. I can give you the timeline for our most recent work on the American elm trees. So, we have partners that find these survivor American elms and send us branches from those trees. It takes us about three years to get them propagated up and get enough crosses grown that we can plant those out. Five years later, we can actually inject the Dutch elm disease fungus into those trees and see if they have resistance or not. If they die, they don't have good resistance, if they survive and seem to stay very healthy, then they do have good resistance. So, all together, so far, we're already talking about 10 years. At that point, we've identified the trees, and then those can get planted in a seed orchard where they would cross with each other and produce seeds for restoration, and those trees that we've identified could also be good cultivars for planting in urban areas. The next step, of course, would be to actually test those trees in urban areas, see how they grow when subjected to all the stresses that there are in a city when you're a tree, and then to test the trees from the seed orchards and test planting methods and how they grow when they're planted out in natural areas.

Jonathan Yales

Like all restoration stories, in order for Kathleen to do her research, a planting stock is needed. She needs trees in order to try them out, out on the landscape.

And, at the Delaware, Ohio research station, Kathleen, Leila from the last episode, as well as research ecologist Charlie Flower, manage a tree plantation. And, on a fall afternoon, they took me out to see some of their elms.

Jonathan Yales

So, where are we going?

Kathleen Knight

So, we are headed out to the elm plantation. We have two big fenced areas here—the fences are to keep the deer from eating our little trees, because deer love elm. Around 5,000 elms, mostly older trees that have grown here for a while and already been inoculated.

Jonathan Yales

And, what does the inoculation process look like?

Leila Pinchot

We actually take an electric drill and drill into the base of the tree about a foot up, just a few millimeters. And then, using a pipette we inject a solution that includes the Dutch elm disease fungal spores in it, into the tree, and it gets, basically, taken up into the vascular cambium.

Kathleen Knight

So, the elms that were inoculated here and survived, and were the best performers here, are then the elms that get tested in these riparian plantings and urban plantings to test how they perform in those conditions. We want to know how they respond to compacted soils, and salinity, and all of these other issues in a city.

Charlie Flower

So, the varieties on the left here were largely sourced from a collaborator in Michigan. So, he's a farmer in Michigan and an elm enthusiast, and so, he and his father would travel around the landscape of Michigan kind of identifying survivor elms. And so, the majority of the material here on the left was sourced from those efforts, and we just inoculated them in 2018, and we've subsequently tested them out at this stage, so we got one-year decline categories on them.

Kathleen Knight

So, each of these have a number tag on them. And so, we keep track—this is number 3145. We keep track of what genotype each tree is, or what cross that came out of, as well as its performance after being inoculated with Dutch elm disease. And, some of them, in addition to that tag, will have a rectangle tag that has the name of the tree on it. And so, our collaborator, Dale Lesser, names them after towns that they come from, or—so we have trees that are named things like 'Sunfield,' that have performed well. Some of the other trees we've named much less creatively. The more recent trees from New England are No. 29-56, but it's fun to have the ones with actual names that we can look at.

Jonathan Yales

Well, with 5,000 trees, you got to start numbering them at some point.

Kathleen Knight

Right, right.

[Phone ringing]

Dale Lesser

Hi, Jon. Dale Lesser.

Jonathan Yales

Hey, Dale. How's it going?

Dale Lesser

Well, pretty good. I just walked in the door.

Jonathan Yales

Yeah? How you doing today? What were you doing out all day today?

Dale Lesser

Well, let's see.

Jonathan Yales

Dale Lesser grew up on—and still runs—Lesser Farms and orchard in Dexter, Michigan, which is about 20 minutes outside of Ann Arbor.

Dale Lesser

In the morning, I had some honey to get ready for the local store, I got that done, and then I went at working on my bees, and when it was so hot, I worked on them until a big storm came up—I just got done. And then got home and I was just up trying to fix fence, and the mosquitoes were just about carrying me up in the trees—even with this wind—and then the deer came out and they were snorting at me, and that ticked me off. And, as I came home, I must've seen 20 deer out eating in the soybeans. So, I don't know, we got a lot of competition, let's just put it that way.

Jonathan Yales

Dale grew up in Michigan during the 60s, and he remembers seeing Dutch elm disease arrive as a kid.

Dale Lesser

We built a barn, we built a hip roof barn, so we were cutting lumber, cutting down trees, to build the barn, and they made the—well, some of the stuff they made out of elm—and the elm trees were dying then, and that was 1965, they were dying really hard. And so, that's when it first came and, of course, we were kind of alarmed, but I remember we did that and they kept dying in the woods and we probably cut wood out of—I mean, in our woods, there was a tree that was a good six feet through that was an elm tree, and it took it quite a while to fall over—so, we cut wood, and of course, it finally got really rotten and stuff. So, well, as long as those elm trees were kind of on the skyline you always could see some elm trees, but when they were finally gone, you didn't see any more. So, it was kind of rare then. After that, when I started to see one that was still alive and, like, there were about seven over a period of time in my little circle here that I knew all of that had still survived.

Jonathan Yales

What Dale was seeing were ‘survivor’ elms, or elms that were potentially tolerating the Dutch elm disease.

Dale Lesser

We rented a neighbor's farm and he had a ditch that he never kept the brush out of, and so, we had to cut the trees off from one side of the ditch so that we could clean the ditch, and it was all elm trees. And so, we were cutting down all these elm trees, and it was just about the time that that second growth of elms were probably about a foot through—eight inches to a foot some of them, or maybe, you know, 18 inches or two feet, but not many of these—and the Dutch elm disease was just marching—it was really killing elms again. And, I was a little concerned because I'm in the Ann Arbor [Michigan] area and there's a lot of people that are very environmentally concerned, and I was afraid that they might see us as anti-tree or something because we were cutting down all these trees. I was also feeling bad about the elms because they were all dying again, and I was thinking a whole lot more serious about these elms that still existed that I knew about that had resistance, so I thought, there's gotta be somebody out there that could use these survivor elms in a project to try to find resistant elms. That's when I went—it was about the time the internet got going, or I learned how to use it—and so I went looking for Dutch elm disease resistant elm trees and found where some had just been released by Dr. Denny Townsend, from the Washington D.C. area, and so, I thought, ‘Well, I'm going to call him!’ which I did.

[Phone ringing]

Denny Townsend

Hello, you must be Jon?

Jonathan Yales

Yes, Denny?

Jonathan Yales

Denny Townsend is a retired research geneticist who worked for the USDA's Agricultural Research Service, and the U.S. National Arboretum.

Denny Townsend

It kicked off about 1969. I was finishing my PhD, and I was looking for a job. So, I wrote to a new research leader at Delaware, Ohio and asked him if he was interested in hiring me to be a tree geneticist. And, he wrote back, ‘Yes, come on down to interview for the job,’ and I actually got the job. I started in January 1970, and he wanted me to focus on the elm.

Jonathan Yales

Like Dale, Denny also remembers the big elms.

Denny Townsend

So, I moved around a lot, my dad was transferred a lot, but one of the towns I lived in was Marietta, Ohio, and they had American elms lining real broad streets. And, in fact, one of the biggest—maybe, the biggest—American elm in the country was in Marietta, Ohio—it was called the ‘Rathbone elm’—but it died of Dutch elm disease about 1959. So, I remember the American elms on the city streets.

Jonathan Yales

In his early days at Delaware, Ohio, Denny was focused less on the elm trees, and more on the disease itself. Back then, we were still trying to just understand the fungus.

Denny Townsend

The first thing that Larry Schreiber and I did was to collect samples of the fungus that causes the Dutch elm disease. We collected the fungus from, I don’t know remember, maybe 30 or 40 sites throughout wherever American elms were alive and had the Dutch elm disease. And then, we evaluated the aggressiveness of these different strains of fungus, and generally, we ended up with some non-aggressive than others very aggressive. And, later on it was shown that there were, actually, two different species of the fungus that create Dutch elm disease. So, after that research, we always used a mixture of aggressive and a non-aggressive strain of the fungus.

Jonathan Yales

Like it’s still done today in Delaware, Denny’s research started with taking healthy trees, and inoculating them with the disease, in order to find the trees that stood up better.

Denny Townsend

Yeah, I remember doing a lot of inoculations after we pinned down the nature of the fungus—inoculating thousands of trees. It was a very time consuming job, and had to be done at the right time of the year. So, we had to do this on all these trees and then, finally, we would select, maybe, 25 trees—the top 25 trees—and among those top 25 trees was one tree, at the time it was called Delaware No. 2, that was the best tree that was found in, I think, Morristown, New Jersey, by the USDA. I think they screened 35,000 trees. So, that tree we called ‘Delaware No. 2,’ and that was kind of a base from which we could work.

Jonathan Yales

Now, remember, this was all happening in the mid to late 70s, right around when Dale was snooping around up in Michigan with his seven survivor elms. But, time was running out.

Dale Lesser

Of the seven that I knew about, about the time that I probably graduated from high school or a little time after, which was 1972, there were only three still remaining. So, that was another reason why I thought it was kind of important—if you’re going to do anything about this, we need to do it now, before they all get cut down or something. There were only three left. And so, those were the first three that I experimented with, and that I learned, sort of, the best ways, the most productive ways, to chip bud, and the most productive ways to take the cuttings. And, the top of the tree is where you needed to get cuttings from, but some of them were a hundred feet tall and I’d be, you know, I’d be out there remotely and I didn’t have tons of money. And so, I bought the longest pole saw that was advertised on

the internet, extended it an additional, I don't know, 16 feet—I made it 43 feet long, anyway—and it was quite a job to get it lifted up in the air, and then you had to balance it. And, some of the trees, the bottom limbs, I could barely reach, but for budding, it wasn't so important, you know, you just needed buds that were healthy, that weren't flower buds, reproductive buds, you needed vegetative buds and I could bud onto these seedlings and then you would force the buds in the spring and they would grow like crazy and they'd create this beautiful juvenile growth that then you could take cuttings from and try to get roots. But, then I was faced with, I tried— I wasn't having a lot of success. But, I had talked to Dr. Townsend, and he put me in contact with Jim Slavicek, who was running the program in Delaware, Ohio, and so, we talked a little bit. And, I had been told by someone else that I needed 30 rooted cuttings of each selection, so, I worked with them for years, and I would do, like, eight half flats of 36 cuttings of each one, and one year, I did a 10 different varieties—or 10 different individuals—so that was something like 2,880 or something cuttings that I made and put under the mist bench. It was kind of a lot of fun meeting all those people, people that have the same interests as you.

Jonathan Yales

Yeah.

Dale Lesser

And, it was interesting, because a lot of people were rooting for me because they said, 'You know, this looks like this probably will work, you know, this hopefully should work.' And so, that's kinda how I got started. And then, Jim and his elm researcher, Steve, they would take our cuttings. And, it was after that then that I talked to the editor of Michigan Farmer, and told her about what I was doing, and they liked to put little interesting stories like that in once in a while in their magazines, and so I got calls from around Michigan, because I asked for farmers—or others—that knew of survivor elm trees that were probably, for sure in excess, or at least three feet through, and if they would have survived from that first epidemic that was in the late 60s in this area. And, so I got quite a few calls. They were all over the state, but I found them, that was my first effort. And then, I went to some of the big tree registries, because I was running down through Ohio, and then I became almost obsessed with it because I'd be driving—especially in the winter—and I'd be going down the highway and I'd see one. And, I saw several in Ohio that I took cuttings off from, and I ran across some in Michigan, and then the big tree registry took me all the way down to Chillicothe, Ohio, and over to Washington, Indiana, and over to a little town called Lyford, Indiana, and I made trips and took buds off from those.

Jonathan Yales

So, you're driving around the country. You're putting in ads, you know, in the Michigan Farmer. You're doing all these steps—you're growing these trees, you're passing them on to Delaware, and other places, and you're working with, you know, the botanical garden at the University of Michigan—are you, like, getting paid or any—like, what are you getting out of this?

Dale Lesser

I had costs, and I kind of kept track of it—I kept a log of all of my costs. I had this dream that, maybe, if we came up with a super, super tree, that everybody would be interested in it, and that maybe we could pull, like, between myself and USDA, maybe we could pull a plant patent or something. It just seemed like a good idea, but I never had any luck with that. And so, that never really panned out. So, I guess I

really, I didn't get any income from it, but I met a lot of interesting people, and it's been fun to work with PhDs that find your work interesting. And, I don't know, on the farm here, we don't make a lot of money at anything, so you try to make even your hobbies pay, and that was my effort, I guess, along those lines. Keeping bees was one of my hobbies, too, and we made that into a paying enterprise, the orchard's the same way. You try to make each one pay, but this one, I guess, is going to be just probably a hobby.

Jonathan Yales

Yeah.

Dale Lesser

On the farm, you either figure a return on your investment or you figure a wage, but there's no way you'll get both a wage and a return on your investment at the same time.

Jonathan Yales

Yeah.

Dale Lesser

It's just—it doesn't pay that well, you know? You get about a 3% return on investment with nothing for wages, your own personal wages. I really haven't gotten anything but the satisfaction that it was fun.

Jonathan Yales

Dale is a great example of how a member of the public can get involved with major science, and how partners like him are instrumental in the PhDs and agencies like us accomplishing anything. To this day, Dale is still involved with Kathleen, Leila, and Charlie, and is still sending cuttings.

Dale Lesser

You know, elms are in no danger of extinction, they've become a juvenile species, they only get so big and then they succumb to the disease. They'll just produce the most unbelievable seed crop just before they die, drop all those seeds, and then you get another flush of them coming up again. So, eventually, nature sort of cures this problem of a non-native disease coming in and just killing almost everything. It becomes diseased and everything sort of comes back into equilibrium, but in the meantime, we're trying to help it out, so we can once again have these stately elm trees in people's lawns and back out in the wild.

Jonathan Yales

Even though elm isn't in danger of going extinct, we still need to allow ourselves to feel the weight of a possible species loss.

Denny Townsend

You know, I think it's important to try to save every species of trees, maybe even generally, try to save species around the world of all plants and animals. It's important to save these species because they have genes that might not seem important right now, but they may have importance in the future.

Because we don't know if there might be a gene that American elm might have that would confer some sort of resistance in ash to the [emerald ash] borer. I don't know, but anyway, it's the idea of saving the species.

Jonathan Yales

And, as for ash, that's its own story.

Kathleen Knight

So, each of these species is being impacted by a different pest or disease that's been introduced at a different time point. But, as one species drops out, the forests' respond and other tree species may fill in those gaps. So, for chestnut, it was oaks that kind of filled in many of the areas that we lost chestnuts. For the American elm, in some areas, ash was actually the species that filled in in wetland forests, as well as being planted on streets and cities that used to be lined with elm—they replanted a monoculture of ash. And now, of course, we have emerald ash borer affecting the ash.

Jonathan Yales

Both of our stories so far—elm, and chestnut—have shown how the public can intimately involve themselves in species restoration efforts.

With chestnut, it was as simple as carrying on a longing for the old, lost tree, but it is also present in the work of the American Chestnut Foundation every day.

With elm, Dale Lesser, is an embodiment of the public partnering with a number of organizations and agencies in order to help fix a problem he cares deeply about.

And, in our final episode—the story of ash restoration—you'll see what's possible when public and private partners work together, at scale, early on, to maybe, just maybe, create a new model for how we combat these sorts of species-jeopardizing issues.

Jennifer Koch

That is sort of the future, building that network so that we have the capacity to do that, and the thought was that ash could serve as the model across Canada and the U.S. of how do we build these networks and mobilize them, and once we've done that, it will be really easy for us to then plug in the next species, because we'll already have these networks intact.

Jonathan Yales

That's next time on Backcross. See you next week.

Jonathan Yales

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Thanks for listening. See you next week.